Exemption No. 7090

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of

Dornier Luftfahrt GmbH

for an exemption from § 25.841(a)(2) and (a)(3) of Title 14, Code of Federal Aviation Regulations

Regulatory Docket No. 29531

DENIAL OF EXEMPTION

By letter of March 26, 1999, Dr. W. M. Wallwitz, Director, Airworthiness and Certification, Airworthiness Office, Dornier Luftfahrt GmbH, P.O. Box 11 03, D-82230 Wessling, Germany, petitioned for an exemption from the cabin pressure altitude limit requirements of § 25.841(a)(2) and (a)(3), of Title 14, Code of Federal Aviation Regulations (14 CFR). The proposed exemption, if granted, would allow the Dornier Model 328-300 airplanes to operate up to a maximum altitude of 35,000 feet instead of 31,000 feet, which is the currently approved limitation.

The petitioner requests relief from the following regulations:

> **Section 25.841(a)(2)** states that the airplane must be designed so that occupants will not be exposed to a cabin pressure altitude that exceeds the following after decompression from any failure condition not shown to be extremely improbable:
> (i) Twenty-five thousand (25,000) feet for more than 2 minutes; or
> (ii) Forty thousand (40,000) feet for any duration.
>
> **Section 25.841(a)(3)** states that fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.

ANM-99-388-E

The petitioner's supportive information is as follows:

"Pursuant to the Code of Federal Regulations, Title 14 [14 CFR], part 11, and specifically section 11.25 thereof, Dornier Luftfahrt GmbH, manufacturer of the Dornier 328-300 model Aircraft, hereby files for exemption from [Federal Aviation Requirements] FAR 25.841 (a)(2) and (a)(3) (at Amendment 87) relating to pressurized cabins, in establishing the certification basis of the subject airplane. The following information is provided in support of this petition."

"1.0 Substance of rule from which relief is sought:

"FAR 25.841(a) at Amendment 25-87 requires that occupants of a pressurized cabin not be exposed to a cabin pressure that exceeds 25,000 ft. for more than 2 minutes following a decompression from any condition not shown to be extremely improbable (a)(2), and that engine failures be included in evaluating the decompression (a)(3).

"2.0 Nature of extent of relief sought:

"The Dornier 328-300 airplane is an updated and re-engined version of the Dornier 328-100 airplane approved by the FAA on November 10, 1993 (TC No. A45NM). The Model 328-300 is classified as a derivative by the European Joint Aviation Authorities (JAA) but, because of the change from turbopropeller to turbofan propulsion, has been deemed a new type design by the FAA pending a decision on a petition filed to achieve the derivative status by FAA as well. Although the altitude for the initial certification may not be limited by this requirement, Dornier intends to request an increase in the maximum certified altitude in the near future. Exemption from the requirements of FAR 25.841(a)(2) and (a)(3) as amended by Amendment 87 is therefore sought.

"3.0 Description of aircraft covered:

"On November 10, 1993, Dornier Luftfahrt GmbH received the U.S. FAA Type Certificate (No. A45NM) for the 328-100 Aircraft Model. The Dornier 328-100 is a twin-engine, high wing turboprop transport category airplane with a maximum seating capacity of 33 passengers. It is equipped with a 5 tube digital EFIS/EICAS system and a conventional flight control system.

"On October 30, 1996, Dornier Luftfahrt GmbH filed an application for a Joint Certification for the Dornier 328-300 to the JAA and on November 14, 1996, to the FAA. The Dornier 328-300 is a 30 to 33 seat Regional Transport Aircraft, equipped with two Pratt & Whitney Canada PW3O6B turbojet engines mounted under the wing. Many of the components, structure, and systems are unchanged from the model Dornier 328-100.

"The new model Dornier 328-300 includes the following major changes compared to the Model 328-100 airplane:

"-New engines (Turbofan)
-New engine pylons & nacelles
-Local wing structural modifications
-Increase of some design weights
-Modification of the main landing gear
-System modifications

"As the Dornier 328-300 is designed to be the "turbofan version" of the Model 328-100, all modifications are focused on the integration of the new type of engine and on the necessary adaptation of systems. The changes incorporated are restricted to modifications, which are directly related to the integration of the new engines.

"The overall dimensions, the primary load paths, the geometry of the wing, fuselage, and empennage, and the entire flight control systems are unchanged.

"4.0 Information provided in support of petition:

"The Dornier 328-300 airplane is designed consistent with accepted and approved standards and practices, as evidenced by prior certification of the Dornier 328-100 airplane which has been previously approved by the FAA and the European Authorities. This design has demonstrated compliance with FAA and International airworthiness requirements prior to the adoption of Amendment 87 to FAR part 25 in July 1996. These same requirements and practices were applied to virtually all transport category aircraft in operation and being delivered to the world's airlines today.

"Amendment 87 introduced requirements limiting the exposure time of cabin occupants to cabin pressure altitudes above 25,000 ft. following a decompression. In addition, engine failure, including uncontained failures, was specified as one cause of decompression.

"The severity of a turbojet/turbofan engine rotor burst has been shown to be such that no known structure can withstand the energies imparted to large, uncontained rotor segments. Although the fuselage structure must be designed to withstand the resulting decompression (FAR 25.365(e)(1)), the impact of such an event on a pressure cabin creates a decompression opening in excess of any previously required by the regulations (FAR 25.365(e)(2)) in determination of occupant oxygen requirements.

"The only known means of limiting the cabin pressure altitude exposure of the occupants following such a severe decompression is to limit the maximum approved altitude to less than 40,000 ft., and to one from which a pressure altitude of 25,000 ft. can be achieved within two minutes of the decompression.

"This type of limitation would apply to many of the transport category airplanes in operation and being produced in the world. For the Dornier 328-300 airplane, this would require a limitation to a maximum pressure altitude of approximately 31,000 ft., which is clearly far from that desired for efficient operation of a turbofan transport, and which would result in severe air traffic control restrictions in certain regions of operation.

"An altitude limit such as this would also place the Dornier 328-300 at a severe competitive disadvantage with previously approved airplanes being marketed in the same class, which are not required to meet the same severe requirement. Dornier does not believe this should be the intent or the effect of an amendment to the regulations.

"The Dornier 328-300 complies with all other requirements for occupant oxygen requirements, and with all structural requirements of FAR part 25. The Pratt & Whitney Canada PW306 engine is a derivative of the P&W305, which has an excellent record of service and safety, with no history of in-flight shutdowns or uncontained engine failures.

"5.0 Reasons why granting an exemption is in the public interest:

"The Dornier 328-300 is scheduled to begin passenger operation in the U.S. in the second half of 1999. Dornier plans to deliver seven airplanes to customers during 1999. The Aircraft will be certified to later FAA/JAA airworthiness standards than most competitive models on the market. This means that the latest safety standards have been applied to the aircraft.

"Considering the fact that the Dornier 328-300 meets the later certification/safety standards, it is therefore in the interest of the traveling public that operation with the aircraft be possible at an early point in time.

"If efficient and economical operation of the Model 328-300 in the planned time frame is not possible, the customer airlines might be forced to acquire other airplanes which may provide a lesser standard of safety.

"6.0 Reasons why granting an exemption will not adversely affect public safety:

"The Dornier 328-100, which has been in operation in the U.S. market since early 1994, has accumulated approximately 500,000 flight hours without any remarkable incident or accident which could be addressed to the aircraft design features.

"The Dornier 328-300 airplane is designed and will be certified to FAR 25 through Amendment 87, except as requested by this petition. This is a later certification basis than most or all competitive transport airplanes in this class. The conventional layout of the airplane provides excellent flying characteristics, free of high angle of attack problems. Thus, the safety standards applied to and demonstrated by the Model 328-300 meet or exceed those of other competitive airplanes currently operating and/or being produced and offered in the market.

"The P&W306 engine is a derivative of the P&W305, which has approximately a half million hours of service with no in-flight engine shutdowns or failures.

"The achieved level of safety in the event of cabin decompression is equivalent to other competitive airplanes currently operating or being offered to the airlines. This level of safety has proven to be acceptable in years of transport aircraft operation.

"Application of an upgraded decompression requirement, for which there is no known solution, could result in penalizing the Dornier 328-300 in operating flexibility and performance, thus making the aircraft less attractive to the operators. The increased certification standards of the Model 328-300 would be denied to the traveling public if the operational penalties imposed by FAR 25.841 at Amendment 87 render the airplane economically unattractive to the operators.

"Substitution of derivative airplanes certified to older regulation amendment levels would not be in the interest of public safety.

"7.0 Summary of Dornier's Petition:

"This petition seeks exemption from the cabin decompression requirements of FAR part 25, paragraphs 25.841 (a)(2) and (a)(3) in determination of the certification basis for the Dornier 328-300 airplane. The subject paragraphs were introduced by Amendment 87 to FAR part 25, in July 1996. These paragraphs introduce new requirements for maximum cabin altitude in the event of decompression from causes including engine failure at high altitude.

"The Model 328-300 is a re-engined version of the Dornier 328-100 which is currently in operation in the U.S. and other countries.

"There is no known means of preventing the damaging effects on the cabin structure of an uncontained engine rotor failure at high engine speeds, other than placing the engines behind the pressure cabin. Failing this, compliance with this rule would require the maximum approved airplane altitudes to be limited to below current operating altitude.

"Very few, if any, transport category airplanes in this class currently operating or in production are capable of meeting this amended rule. Imposition of this requirement on the Dornier 328-300 would render the airplane less attractive to operators, compared to other airplanes being marketed which are not required to meet this standard.

"Dornier does not believe there is a demonstrated need nor an acceptable solution for these increased requirements, and does not believe it is the intent of the FAA to cause severe penalties in the design and operation of some transport aircraft relative to competing designs.

"Dornier therefore petitions for exemption from the requirements of FAR 25.841 (a)(2) and (a)(3) for the Model 328-300 airplane, and requests FAA concurrence with this petition."

A summary of the petition was published in the Federal Register on April 20, 1999 (64 FR 19403). No comments were received.

The Federal Aviation Administration's analysis/summary is as follows:

The Dornier Model 328-300 airplane is the first transport category airplane required to meet Amendment 25-87. Prior to Amendment 25-87, however, several airplanes were certified with special conditions addressing high altitude operations as part of the type certification basis. The Dornier Model 328-300 airplane is a "re-engined" version of the Model 328-100, i.e., the turbopropeller engine that powered the Model 328-100 has been replaced with a turbofan engine.

The petitioner requests relief from the maximum cabin altitude limitations established by the provisions of § 25.841(a)(2) and (a)(3) introduced by Amendment 25-87 on June 5, 1996. The limitations protect aircraft occupants from high altitude pressures in case of decompression caused by any failure condition not shown to be extremely improbable. Cabin pressures may not exceed those at 40,000 feet for any period of time, nor exceed those found at 25,000 feet for more than two minutes.

Amendment 25-87 established new requirements in §§ 25.365, 25.831, 25.841, and 25.1447 to upgrade the airplane and equipment airworthiness standards for subsonic transport airplanes to be operated up to an altitude of 51,000 feet. This amendment was based on special conditions used for type certification for many years. During the regulatory process involved in Amendment 25-87, the FAA issued a notice of proposed rulemaking for public comment. No adverse comments were received. While some information has since been submitted to the FAA indicating that compliance with § 25.841(a)(2) and (a)(3) would impose operating and/or design restrictions on many new or derivative airplanes, there has been no detailed corroborating data provided with these statements to substantiate the degree of the perceived operating penalties. At this time, the FAA has no evidence to support relaxing the standards imposed by Amendment 25-87.

The FAA acknowledges that compliance with certain aspects of Amendment 25-87 may require new and innovative solutions to allow airplanes to safely operate at higher altitudes. However, at this time, the FAA has insufficient data to determine the level of difficulty that airplane manufacturers could incur in attempting to meet this requirement. The FAA has tasked the Aviation Rulemaking Advisory Committee (ARAC) to review these and other issues associated with cabin ventilation, pressurization, and other cabin air quality/environment issues. However, as noted later in this analysis, the FAA considers the requirements of § 25.841(a)(2) and (a)(3) to be justified and does not anticipate amending these sections.

The FAA does not dispute Dornier's statement that "The Dornier 328-300 airplane is designed consistent with accepted and approved standards and practices, as evidenced by prior certification of the Dornier 328-100 airplane which has been previously approved by the FAA and the European Authorities. This design has demonstrated compliance with FAA and international airworthiness requirements prior to the adoption of Amendment 25-87 to 14 CFR, part 25, in July 1996. These same requirements and practices were applied to virtually all transport category aircraft in operation and being delivered to the world's airlines today." However, the FAA would clarify this statement to add that certification of an airplane is based upon that airplane's specific design features and operational considerations. The FAA concludes that upon consideration of the Dornier Model 328-300's design features and operational limitations, granting an increase in the maximum operating altitude from 31,000 feet to 35,000 feet would be a reduction in safety that is not in the public interest.

The FAA does dispute Dornier's statement that "…compliance with this rule would require the maximum approved airplane altitudes to be limited to below current operating altitude.…" The Dornier 328-300 does meet the provisions of § 25.841(a)(2) and (a)(3) when operated to a maximum operating altitude of 31,000 feet as currently certified.

The FAA recognizes that Dornier Model 328-300 is a re-engined version of the Model 328-100 airplane with a turbofan engine replacing the turbopropeller engine. However, due to the change in the propulsion system requirements of § 21.19(b), the Dornier Model 328-300 must meet the requirements of Amendment 25-87 to receive a new type certificate. Several manufacturers had to meet similar requirements because of their airplanes unique operating altitude. They were issued special conditions addressing high altitude operations as part of the type certification basis. No attempt has been made to discriminate between the Dornier Model 328-300 and other airplanes. The FAA will hold all manufacturers to the same requirements when they apply for a new type certificate.

The FAA does not dispute Dornier's statement regarding the service history of the Pratt & Whitney Canada PW306B turbofan that powers the Model 328-300. However, § 25.841 requires that failure conditions not shown to be extremely improbable, including consideration of fuselage structure, engine and system failures, must be considered in evaluating the cabin decompression. There is historical data that attests to the fact that engine failures do occur and engine debris does impact and puncture the fuselage. Thus, compliance with Amendment 25-87 requires that this scenario be considered.

The FAA disagrees with Dornier regarding its comment that "there is not a demonstrated need … for these increased requirements." There is compelling physiological literature that contends that subjecting a human to a sudden loss of air pressure (i.e., sudden cabin depressurization) is inherently dangerous and perhaps fatal. The United States Naval Flight Surgeon's Manual and the United States Air Force Flight Surgeon's Guide, provide tables and information that describe multiple effects of such exposure and provide definitions of hypoxia. Both include limits on the "time of useful consciousness" at a cabin equivalent altitude of 25,000 feet and 40,000 feet. For example, at a cabin

equivalent altitude of 25,000 feet, the range of "useful consciousness" varies from 2 to 5 minutes, depending upon the subject's level of physical activity, health, etc. This time is reduced for any level of activity, such that for a "moderate level of activity" the time is decreased to 1 to 2 minutes at a cabin equivalent altitude of 25,000 feet. While passengers may be relatively inactive during the flight, the FAA considers it likely that the flight attendants will be engaged in a "moderate level" of activity. At a cabin equivalent altitude of 40,000 feet, the time of useful consciousness drops from 15 to 30 seconds. Thus, the FAA considers the requirements of § 25.841(a)(2) and (a)(3) to be justified.

The FAA disagrees with the Dornier comment that "The achieved level of safety in the event of cabin decompression is equivalent to other competitive airplanes currently operating or being offered to the airlines." The FAA is unsure what airplanes Dornier is referring to by "competitive airplanes," considering the Dornier Model 328-300's maximum passenger load, intended operating altitude and means of propulsion. The FAA is aware that there are commercial airplanes that meet the cabin equivalent altitude requirements of Amendment 25-87.

In addition, the FAA disagrees with Dornier regarding its comment that "there is not … an acceptable solution for these increased requirements." The provisions of § 25.841(a)(2) and (a)(3) dictate that the reduction of cabin air pressure, due to a system failure or a ruptured fuselage, not reach a level and a duration that constitutes an unsafe condition. One method used to demonstrate compliance is to show that the airplane, using emergency descent procedures, can reach an altitude of 25,000 feet or less in less than 2 minutes. As mentioned earlier, the FAA recognizes that Dornier 328-300 is a re-engined version of the Model 328-100 airplane with a turbofan engine replacing the turbopropeller engine. The Model 328-100 airplane has a maximum operating altitude of 25,000 feet, while the Model 328-300, as presently certified, has a maximum operating altitude of 31,000 feet. However, Dornier's emergency descent procedures are the same for both cases, i.e., in the event that an emergency descent is required, perform a pitch over maneuver and descend along a V_{MO} limit. The Model 328-300 meets the requirements of § 25.841(a)(2) and (a)(3) at the currently certified altitude of 31,000 feet, but limitations in the Dornier approach to emergency descent procedures and in the airplane design make it incapable of meeting these requirements when operating at 35,000 feet. Furthermore, features that are present on the Model 328-100 airplane (i.e., ground spoilers) are not adapted to operation at higher speeds (i.e., inflight spoilers), and are not incorporated into the Model 328-300 design. In addition, some airframe manufacturers submitted material that demonstrates that their existing airplanes (certified prior to Amendment 25-87) can meet these requirements, albeit, not all of their current models. Unfortunately, none of the design mechanisms or operational procedures that allow these airplanes to conduct rapid descents is incorporated into the Dornier 328-300 design or operating procedures. Therefore, the FAA finds that there is sufficient justification to require compliance with these regulations for new model airplanes requiring new type certificates.

In summary, the Dornier Model 328-300 is a re-engined version of the Dornier Model 328-100 series of airplanes and is currently certified to 31,000 feet operational altitude. The requirements of 14 CFR § 21.19(b), regarding a change in the "principles of propulsion." mandate that the applicant applies for a new type certificate that necessitates compliance with Amendment 25-87. In addition, the changes in propulsion and associated airplane aerodynamics which Dornier incorporates into the design, and the emergency descent procedures, limit the airplane's ability to descend quickly in the event of a rapid decompression of the cabin. Also, design features that are present in the Model 328-100 airplane design (i.e., ground spoilers) that could have been modified to improve emergency descent capability are not employed. Thus, the Dornier 328-300 design, and utilization of AFM procedures, does not comply with the provisions of § 25.841(a)(2) and (a)(3) with a maximum operating altitude of 35,000 feet. The FAA sees no reason to grant an exemption to the cabin pressure safety standards that apply to new type designs.

In consideration of the foregoing, I find that a grant of exemption is not in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator (14 CFR § 11.53), Dornier Luftfahrt GmbH request for exemption from 14 CFR § 25.841(a)(2) and (a)(3) to the extent necessary to allow operations on new Dornier Model 328-300 airplanes above 31,000 feet, is denied.

Issued in Renton, Washington, on December 22, 1999.

/s/ Vi Lipski
Vi L. Lipski
Acting Manager
Transport Airplane Directorate
Aircraft Certification Service, ANM-100